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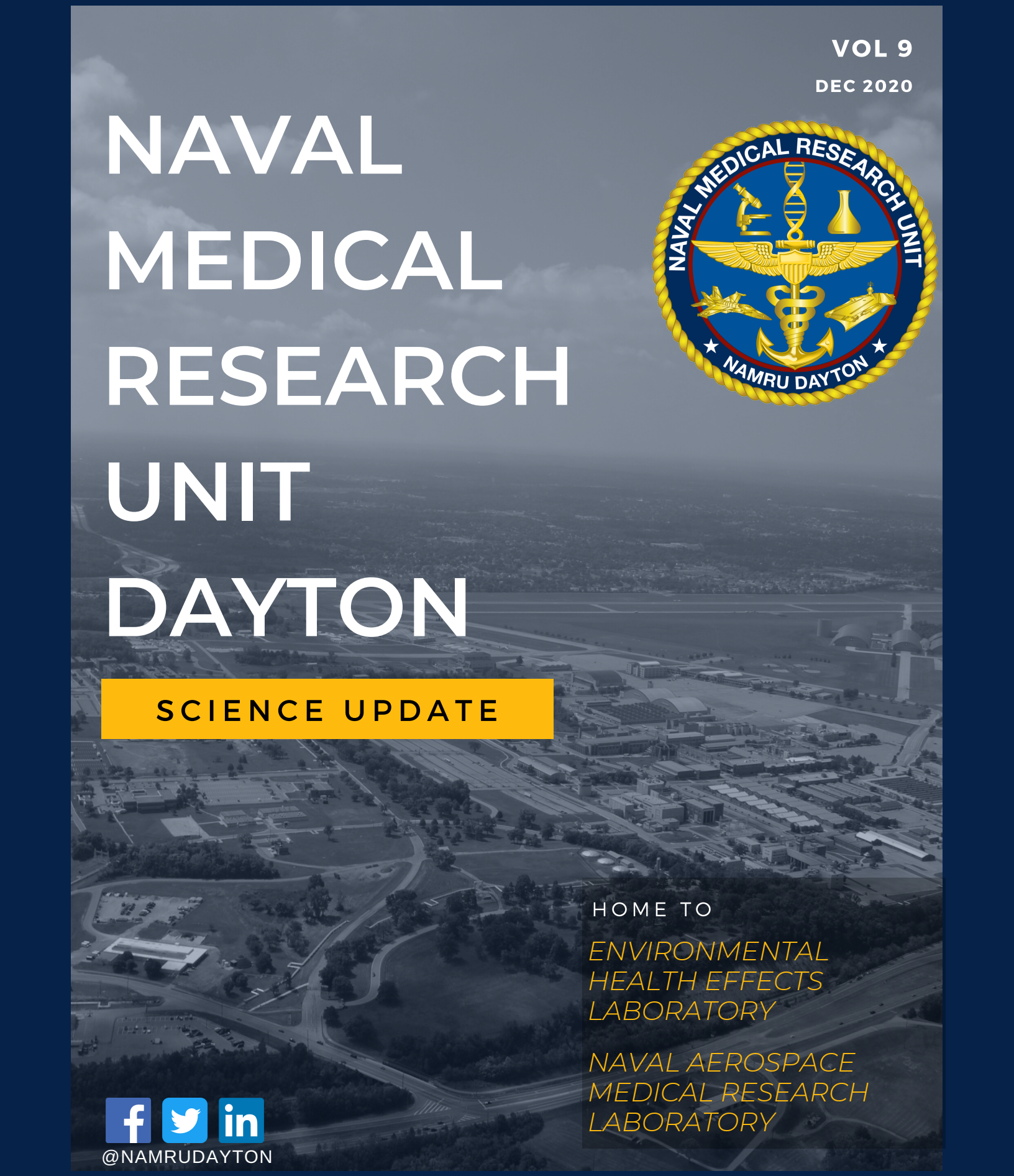
NAVAL MEDICAL RESEARCH UNIT DAYTON

SCIENCE UPDATE



HOME TO

ENVIRONMENTAL HEALTH EFFECTS LABORATORY

NAVAL AEROSPACE MEDICAL RESEARCH LABORATORY

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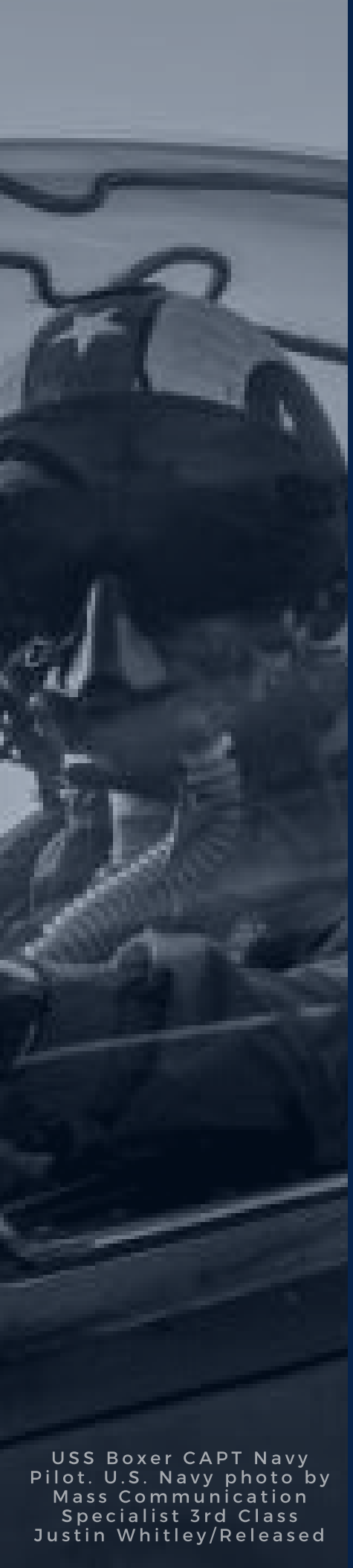


USS Boxer CAPT Navy Pilot. U.S. Navy photo by Mass Communication Specialist 3rd Class Justin Whitley/Released

INSIDE THIS ISSUE

Message from the CO

Captain Nimfa Teneza-Mora

Captain Nimfa Teneza-Mora, Commanding Officer, Naval Medical Research Unit Dayton

As 2020 comes to a close, we reflect on a year with unprecedented challenges. At the onset of the pandemic, a majority of our teams rapidly transitioned to the teleworking environment and study protocols were placed on pause. Nearly nine months later, current health protection condition still limits on the number of personnel at the work site, and greater than 50 percent of staff continue to work remotely. Those who work on site have had to diligently practice risk mitigation measures to ensure staff safety. Data collection resumed for some studies, but at lower rates than originally intended. Many of those who work remotely have had the difficult job of juggling their professional work and family responsibilities as their school-aged children continue remote learning. However, NAMRU-Dayton staff have risen to the challenge, and responded with teamwork, resourcefulness and innovation. We recognize and celebrate the accomplishments, commitment and resilience of our scientists, technical and support staff who have demonstrated that they can weather the worst of winter, overcome adversities, and still stand tall and strong.

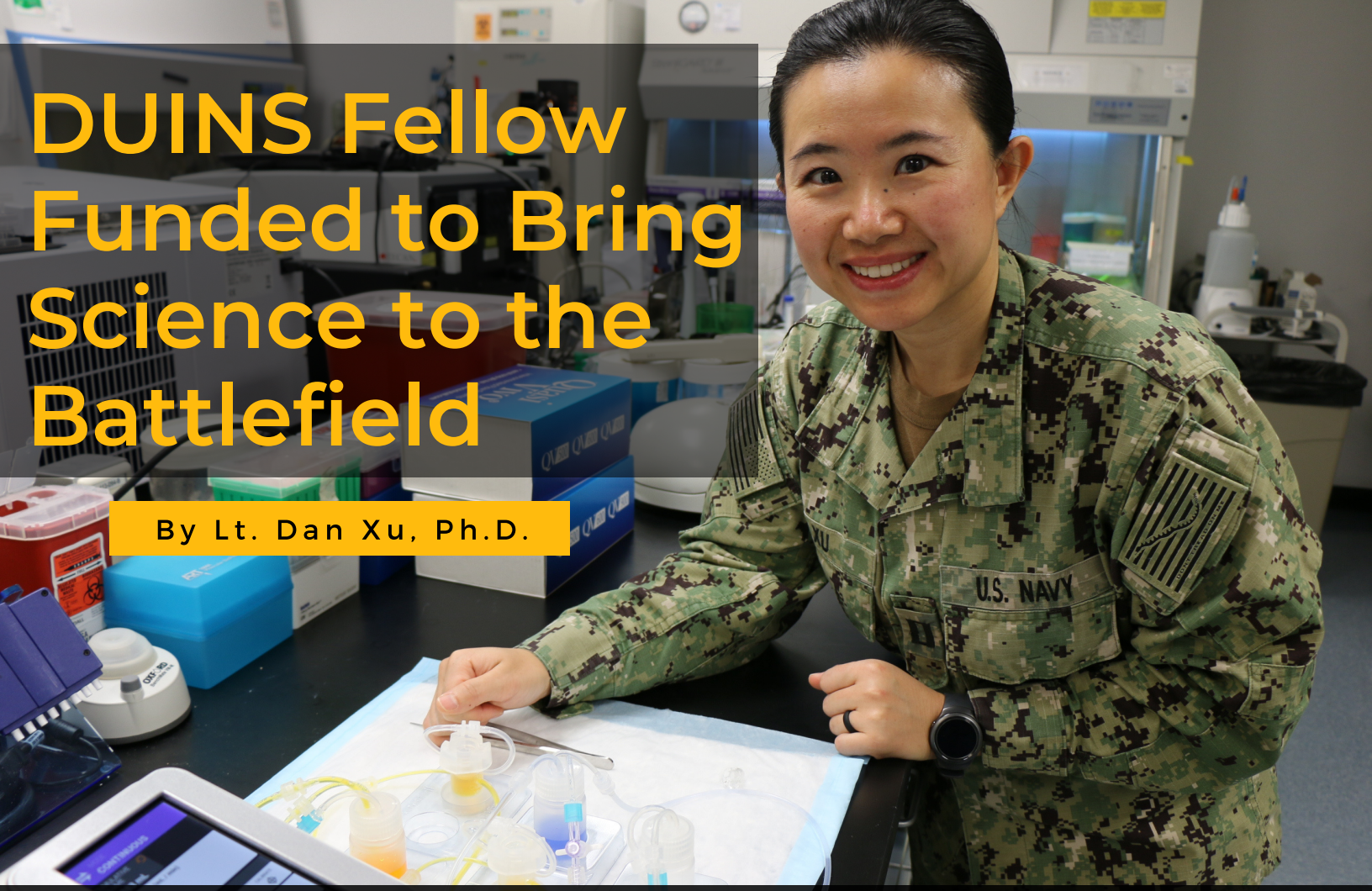
A number of remarkable research efforts that were conducted by our scientists during this difficult year are featured in the 2020 NAMRU-Dayton Science Update. Our scientists were determined to develop novel solutions to optimize the readiness and performance of the Naval and Joint Warfighter. Lt. Dan Xu, a biochemist and a student in NAMRU-Dayton's inaugural Duty Under Instruction (DUINS) program for a graduate level Toxicology Certificate, describes her project to identify biomarkers of exposure to diesel exhaust, a potential highly sensitive method of detecting such an exposure risk. Lt. Cmdr. N. Cody Schaal, an industrial hygienist, seeks to improve current understanding of factors contributing to occupational-related hearing loss. He discusses his ongoing research efforts in the Environmental Health Effects Laboratory (EHEL) that evaluate the effects of continuous and variable noise exposures, as well as noise combined certain chemical exposures, on permanent hearing loss. Dr. F. Eric Robinson, a research psychologist in the Naval Aeromedical Research Laboratory (NAMRL), describes his efforts to better understand factors that lead to spatial disorientation, a leading cause of class A mishaps in Naval and military aviation. He is leading a team of investigators to develop training interventions that can potentially mitigate this risk. Dr. Richard Agans of EHEL aims to understand the effects of probiotics on human performance. He discusses the findings of a comprehensive review he conducted with the Tri-service Microbiome Consortium on current evidence for the use of probiotics supplementation to enhance the well-being and performance of healthy populations, including the military. Dr. Daniel McHail of NAMRL leads a team of investigators to understand the physiologic effects of fatigue on cognitive activities. Such enhanced understanding can assist researchers to design effective interventions for mitigating the effects of mental fatigue and optimize performance in military personnel engaged in military operations.

NAMRU-Dayton has a lot to celebrate as we end this year. Our staff showed incredible determination, teamwork, and focus on executing our mission to support and advance warfighter health, readiness, and performance. Congratulations to our NAMRU-Dayton staff for finishing strong in 2020, a year unlike any other.

CAPT Nimfa Teneza-Mora

DUINS Fellow Funded to Bring Science to the Battlefield

By Lt. Dan Xu, Ph.D.



Lt. Dan Xu, biochemist and DUINS Fellow assigned to Naval Medical Research Unit Dayton is studying toxicity of diesel exhaust in support of Navy Medicine research. Lt. Xu is gaining critical education that will contribute to her scientific foundation and each mission she is assigned to.
(Official Navy Photo by Megan Mudersbach/Released)

In October 2019, Naval Medical Research Unit Dayton (NAMRU-Dayton) was selected as the sole command for a brand new Navy full-time Duty Under Instruction (DUINS) program for the Biochemistry Community for a Graduate level Toxicology Certificate Program. I had the privilege of being selected as the first trainee for this competitive one-year certificate program and in July 2020, I began my training here at the Environmental Health Effects Laboratory (EHEL) at NAMRU-Dayton.

The Medical Service Corps provides the program as a way of preparing each officer to meet critical education and training needs and to enable them to fulfill the mission. In partnership with Wright State University (WSU), NAMRU-Dayton now has another STEM opportunity to equip our naval officers with professional knowledge to prepare them with a scientific foundation for the mission to which they are assigned.

Besides taking courses in WSU's Pharmacology and Toxicology Department, I am a principal investigator conducting toxicology research under the mentorship of Dr. Karen Mumy, Director of EHEL at NAMRU-Dayton.

In a study funded by the Joint Program Committee-5/Military Operational Medicine Research Program (JPC-5/MOMRP), I am designing and using a system called "Circulated Multi-Tissue Organoid Platform (CMTOP)" to characterize toxicity and to identify biomarkers of diesel exhaust. CMTOP uses human pluripotent stem cell derived, three dimensional cultures to mimic human liver, lung and brain organs (which are called "organoids") and communication between them. Our military

personnel can be regularly exposed to diesel exhaust from military vehicles and pollution in dense urban environments. Diesel exhaust is a highly complex mixture that contains particles as well as a variety of gaseous components of toxicological relevance and exposure can cause systemic inflammation and adverse effects on lung, liver and brain activities.

My hope is that this research will pave the way for establishing a low cost, rapid, non-invasive in vitro test platform for military relevant occupational and environmental exposures and disease. If found to be successful, this system could serve as a less expensive and more rapid method to screen for toxicity of various exposures at multiple levels, while saving the more costly animal-based toxicological studies for exposure cases that require more in depth evaluation of health effects in living systems. Additionally, data may be used to develop an in silico model to provide information and recommendation (possible adverse effects, toxic component and exposure limits) during early stages of new chemical/material development/ acquisition process, as well as for risk assessment. Moreover, findings will contribute to developing medical countermeasures and to predict possible environmental pollution threats, all of which will benefit military personnel in combat and noncombat missions, particularly dense urban environments.

Lt. Dan Xu (right), biochemist and DUINS Fellow provides a research initiative update to Dr. Karen Mumy (left), Director of Environmental Health Effects, at Naval Medical Research Unit Dayton. Lt. Xu is looking to characterize toxicity and identify biomarkers of diesel exhaust. (Official Navy Photo by Megan Mudersbach/Released)

SALUTE!

Lt. Dan Xu
U.S. Navy Biochemist

NAMRU-Dayton's Lt. Dan Xu was named the United States Navy's Biochemistry Officer of the Year for 2020!

This award is a testament to specialty expertise, professional acumen, impressive leadership, and inspiration contributions to the Biochemistry community, Medical Service Corps, and Navy Medicine as a whole.

Navy Researches Impacts of Cognitive Fatigue on Attention & Neural Activity

By Daniel McHail, Ph.D., Kyle Pettijohn, Ph.D., Kara Blacker, Ph.D., and Lt. Sarah Sherwood, Ph.D.

Naval Medical Research Unit Dayton's (NAMRU-Dayton) Naval Aerospace Medical Research Laboratory (NAMRL) is addressing the human performance needs of the warfighter by investigating the impacts of cognitive fatigue on attentional control and associated neural activity. During testing, researchers use a headband-like device placed over the participant's forehead to monitor activity in a region of the brain involved in attention, the prefrontal cortex. (Official Navy Photo by Megan Mudersbach/Released)

Operational demands often require the warfighter to maintain attention for long periods of time, for example while standing watch or searching satellite images. However, performance on attention-driven tasks starts to degrade after a period of sustained effort. This effect is due to mental fatigue and can occur in as little as 20 minutes of time on task. To help maximize warfighter performance on tasks requiring sustained attention, it is critical to understand how the brain responds to mental fatigue.

A seedling effort at the Naval Medical Research Unit Dayton's (NAMRU-Dayton) Naval Aerospace Medical Research Laboratory (NAMRL), sponsored by the Office of Naval Research, is currently underway to investigate the effects of mental fatigue on attentional control and associated neural activity. In this study, participants perform computerized tasks that assess their ability to monitor and quickly choose a correct response to a series of visual stimuli. In one variation of the task, participants respond frequently but then withhold their response to frequent stimuli. Together, these tasks tap into cognitive processes that require attention and control through inhibition. Prior to performing these tasks, participants either watch a short video or perform a different attention-demanding task. The prior attention-demanding task is expected to induce mental fatigue and influence subsequent performance.

While participants perform these tasks, researchers monitor changes in blood oxygenation in the participant's prefrontal cortex (PFC), a region of the brain involved in attention. Generally, increased blood oxygenation in a brain region indicates greater

activation of that region. The device that monitors blood oxygenation uses a technique called near-infrared spectroscopy (NIRS). It consists of light sensors embedded in a headband that can be quickly applied and comfortably worn over the forehead. The NIRS system, when compared to other methods of assessing brain activity, is relatively inexpensive and easy to use. These factors will make it easier to transition findings from this study to follow-on efforts in a variety of operational contexts.

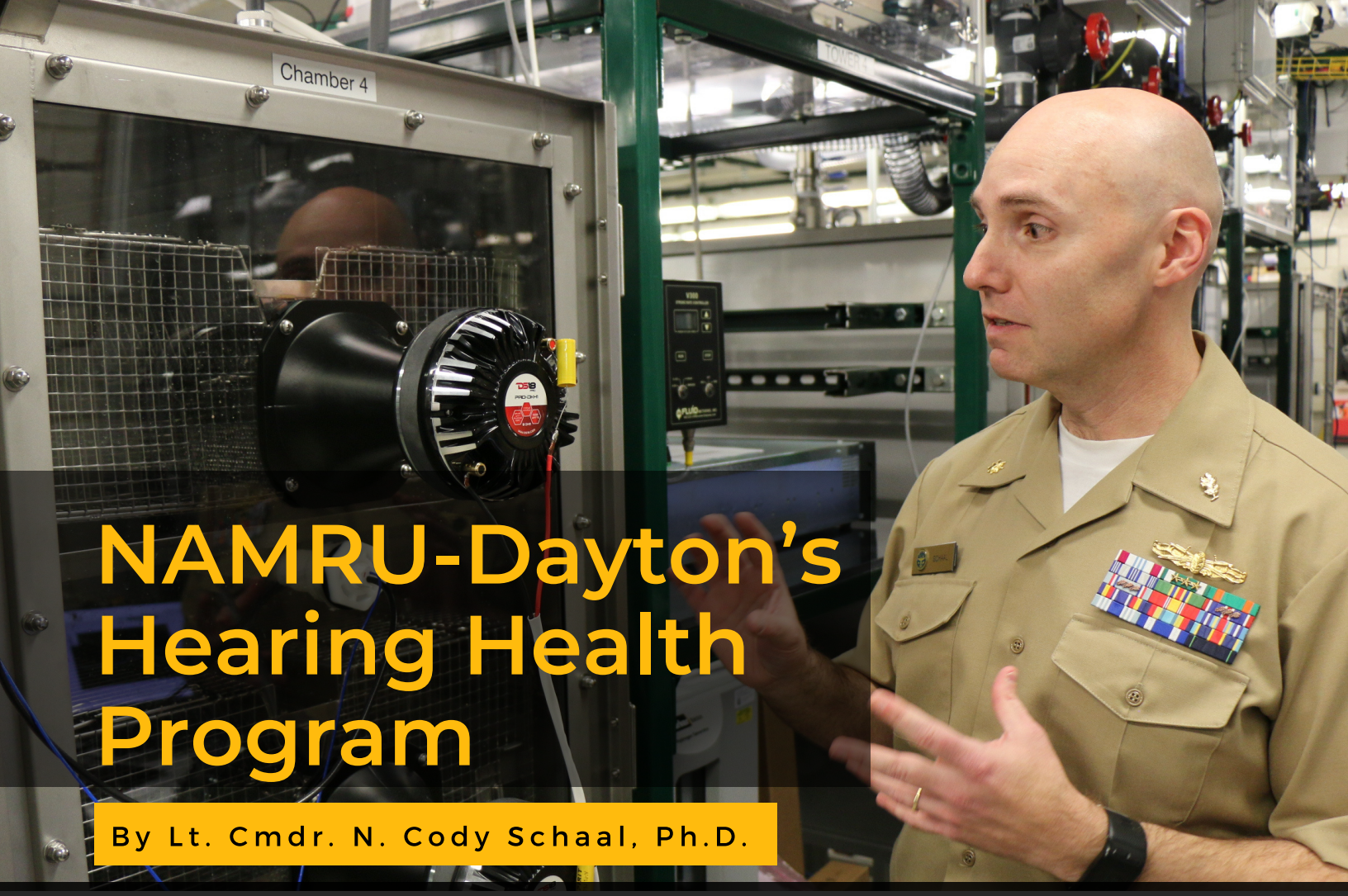
Our preliminary findings suggest that mental fatigue did not negatively affect participants' performance on the attention-driven tasks. However, PFC activation was greater with mental fatigue. This suggests that the brain responded to mental fatigue by ramping up PFC activity in these individuals to maintain performance. This difference in PFC activity was only apparent during the task variation that required both attention and control through inhibition. Once we complete data collection and analysis we will be able to confirm whether or not this trend persists.

Results from this initial study will help us clarify how mental fatigue impacts attentional control and how the brain responds to maintain performance. Looking forward, our follow-on studies will aim to identify individual differences in susceptibility to mental fatigue as well as the effects of mental fatigue on other cognitive abilities including multi-tasking. These results can be used to inform future efforts to develop fatigue countermeasures during tasks that require sustained attention.

A special thanks to team members supporting this study: Caitlin O'Guin, Cammi Borden, Ashley Murray, and Lee Wintermute.

U.S. Navy photo by Mass Communication Specialist 2nd Class Joseph M. Buliavac/Released.

Dr. Daniel McHail, research psychologist, Naval Aerospace Medical Research Laboratory (NAMRL), Naval Medical Research Unit Dayton (NAMRU-Dayton), is the lead investigator on a project looking at the effects of mental fatigue on attentional control and associated neural activity. (Official Navy Photo by Megan Mudersbach/Released)



NAMRU-Dayton's Hearing Health Program

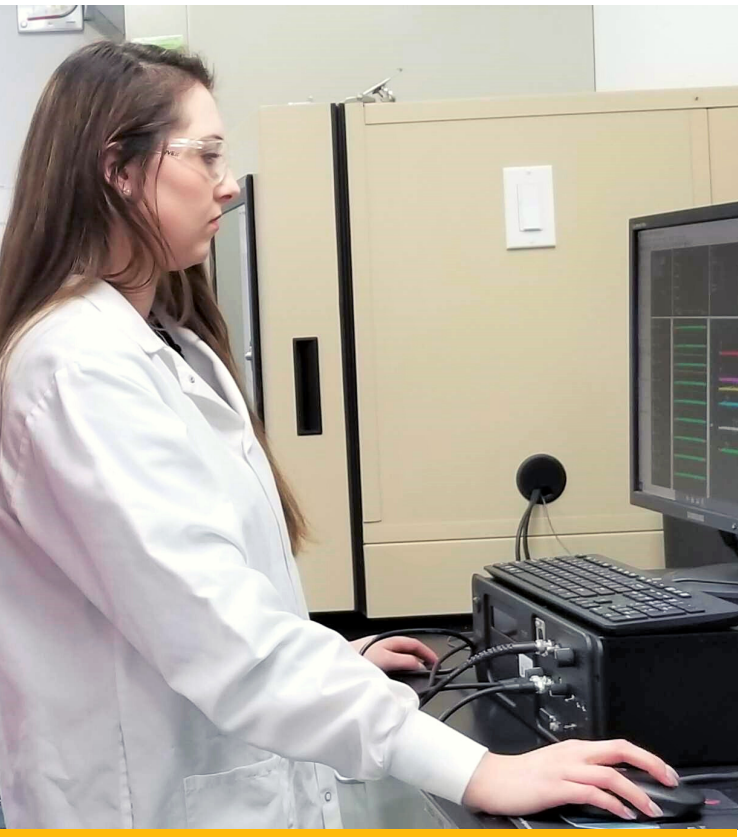
By Lt. Cmdr. N. Cody Schaal, Ph.D.

Lt. Cmdr. N. Cody Schaal, Navy Industrial Hygiene Officer, is currently assigned to the Naval Medical Research Unit Dayton (NAMRU-Dayton) as the Environmental Health Effects Laboratory (EHEL) Deputy Director. Schaal explains how NAMRU-Dayton scientists use unique equipment to assess potential health effects of operational environmental stressors, including hearing health. (Photo by NAMRU-Dayton/Released)

Tinnitus and hearing loss are the two most prevalent service-connected disabilities for separating and retiring service members, as reported by Veterans Affairs (VA, 2020). Hearing injury can result in poor speech intelligibility, poor warfighter performance, and is often irreversible. Naval Medical Research Unit Dayton (NAMRU-Dayton) has a research portfolio dedicated to understanding contributors to auditory disabilities and mitigations to enhance force health protection.

Hazardous noise is traditionally considered the primary risk factor for hearing injury. However, substances called ototoxicants which affect auditory, vestibular, and connected neural pathway function, are reported to be linked to hearing injury, both alone and in combination with noise. Extended duration noise exposure may also present hearing injury challenges. Military personnel assigned to U.S. Navy operational platforms commonly work shifts that last longer than 12 hours per day. When at sea, they work and live in close proximity to sources of hazardous noise. Since most exposure limits represent shorter timeframes and assume a recovery (rest) period exists during non-occupational exposure periods, little is known regarding the increased risk of hearing injury for extended durations of hazardous noise exposure.

With support from the Defense Health Agency Research and Development Directorate and the Office of Naval Research, NAMRU-Dayton's Environmental Health Effects Laboratory (EHEL) research team assessed if permanent hearing



In support of Naval Medical Research Unit Dayton's Environmental Health Effects Laboratory (NAMRU-Dayton/EHEL) hearing health research, Dr. Rachel Howes, audiologist, uses an array of auditory testing devices to measure distortion product otoacoustic emissions and broadband (click) and narrow frequency (tone burst) auditory brainstem response. (Official Navy photo by Megan Mudersbach/Released)

loss develops when a mildly elevated noise level is present during periods when auditory recovery would normally occur. Researchers tested whether permanent hearing loss would be exacerbated by exposure to steady noise levels during a representative occupational time period, followed by an elevated but non-damaging noise level during a daily 16 hour "auditory recovery" period, and an occasional impulse noise exposure. This noise profile was selected to mirror noise exposure characteristics commonly found on U.S. Navy vessels at-sea for Sailors that work and live in environments where hazardous noise areas and hearing recovery spaces such as sleeping areas are in close proximity to one another. Researchers are also investigating if the combined effects of ototoxicants and noise worsen hearing injury when found together. Using in-house custom-built unique noise and chemical exposure systems, NAMRU-Dayton's talented scientists are attempting to model scenarios that would better encompass the entirety of operational hearing injury-related exposures by determining if combined exposure to JP-5 jet fuel and "extended duration" steady and impulse noise exposures intensify permanent hearing loss.

EHEL scientists are also collaborating with researchers from the U.S. Air Force Research Laboratory's 711th Human Performance Wing (AFLR/711 HPW) to investigate occupational and non-occupational noise exposure during 24 hour durations for Sailors, Airmen, and Soldiers. This study will develop an exposure framework for future DoD wide studies, evaluate the efficacy of widely used noise sensors such as an Apple Watch™ as a substitute for noise dosimeters typically used in workplace environments, and assess service member attitude changes in the use of hearing protection during high noise activities on and off duty.

Beyond research, NAMRU-Dayton continues to address hearing injury through working groups involving a variety of U.S. Navy, tri-service, and U.S government agencies. This year, alongside Dr. Andrew Keebaugh, EHEL investigator, we shared research results on extended duration

Reference

Department of Veterans Affairs. 2020. Veterans Benefits Administration Annual Benefits Report Fiscal Year 2019. [accessed 2020 Nov 21]. https://www.benefits.va.gov/REPORTS/abr/docs/2019-compensation.pdf.

November 13, 2019. Naval Medical Research Unit Dayton (NAMRU-Dayton) researchers, Mr. Joe Brune and Mr. Mason Liu, prepare the noise generation system for a demonstration at NAMRU-Dayton's Environmental Health Effects Laboratory (EHEL). EHEL is equipped with a continuous and impulse noise generation system. (Official Navy photo by Megan Mudersbach/Released)

noise exposure and ototoxicant and general hearing conservation information through several working groups. This included the U.S. Navy's Summer Occupational Audiology Symposium, U.S. Navy's Hearing Conservation Working Group, DoD's Tri-Service Toxicology Consortium, NASA's Occupational Health Seminar, NASA's Hearing Conservation Work Group, and the American Petroleum Institute's cooperative research and development meeting.

As a member of the U.S. Navy's Hearing Conservation Working Group, I seek in helping to drive meaningful changes to Navy policy, procedures and guidelines to reduce incidence of noise-induced hearing loss. The team working on this initiative here at NAMRU-Dayton participates in the DoD Hearing Center of Excellence's Collaborative Auditory/Vestibular Research Network to promote collaboration, translation, and best practices that influence auditory-vestibular readiness, care, and quality of life for Warfighters and Veterans.

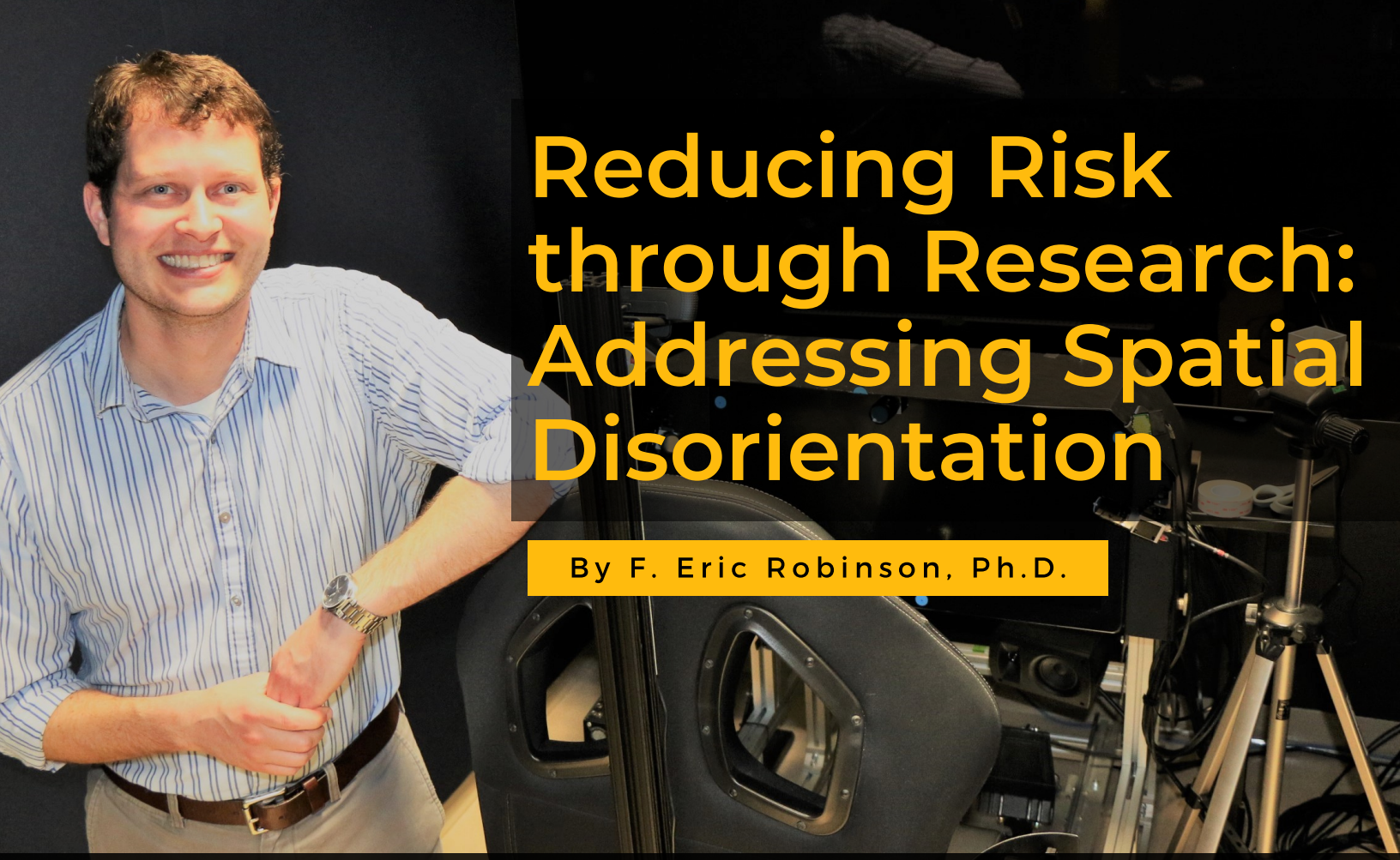
The results of these research thrusts will help define exposure limits for military service members in complex extended-duration exposure scenarios with impulse noise and ototoxicants in a variety of exposure scenarios. Additionally, NAMRU-Dayton's collaboration with multiple Navy, DoD, and other government agencies will protect the hearing health of service members.

SALUTE!

Lt. Cmdr. N.Cody Schaal
U.S. Navy Industrial Hygiene Officer

The Military Outstanding Volunteer Service Medal is presented to Lt. Cmdr. N. Cody Schaal, for outstanding volunteer service to several civilian organizations from MAR 2015 to APR 2020.

Schaal's volunteer service promotes the advancement of the science and engineering community as a whole. From academic science programs, technical content reviews, civilian and military mentoring programs and more, his contributions have been honorable.



Reducing Risk through Research: Addressing Spatial Disorientation

By F. Eric Robinson, Ph.D.

Naval Medical Research Unit Dayton's (NAMRU-Dayton) research psychologist, Dr. F. Eric Robinson is leading laboratory research studies focused on aircrew safety by better understanding cognitive aspects of spatial disorientation - a leading cause of Class A mishaps within the Department of Defense (Photo courtesy of NAMRU-Dayton/Released).

The Naval Medical Research Unit Dayton (NAMRU-Dayton) is engaged in promising research to help reduce the risk of a leading cause of Class A mishaps within the Department of Defense – one that kills pilots and destroys assets every year – spatial disorientation.

Spatial disorientation, or SD, occurs when pilots misperceive the position or attitude of their aircraft relative to the earth or other objects. Part of the reason that SD is such a persistent problem is that the flight environment can mislead our sensory systems, which evolved to handle ground-based inputs. Degraded visual conditions or misleading gravitational cues can interact with high mental workload to degrade situational awareness and increase the risk of a mishap.

NAMRU-Dayton's Naval Aerospace Medical Research Laboratory (NAMRL) addresses a number of aircrew issues including cognitive aspects of SD prevention and mitigation. I am leading two research efforts in the lab; one seeks to characterize basic perceptual contributors to SD, and the other will develop and test a training intervention to help pilots manage attention during periods of high workload.

The first study is a Navy In-house Laboratory Independent Research (ILIR)-sponsored effort in collaboration with Dr. Daniel Merfeld, senior vestibular scientist at NAMRU-Dayton and Vice-Chair of Research in the Department of Otolaryngology at Ohio State University. We are looking at volitional influences on vestibular perception to characterize basic perceptual contributors to SD. Essentially, results will help us better understand how pilots process and interpret vestibular cues.

Most prior research on vestibular perception has relied on passive motion, where a subject's motion is controlled by the research. Findings

from these studies may not directly apply to flight, however, because pilots actively control the aircraft. Active control leads to expectations of outcome (i.e., a pilot makes a control input and expects the aircraft to behave a certain way in response). Expected outcomes may alter how vestibular inputs are interpreted, particularly when such signals are ambiguous.

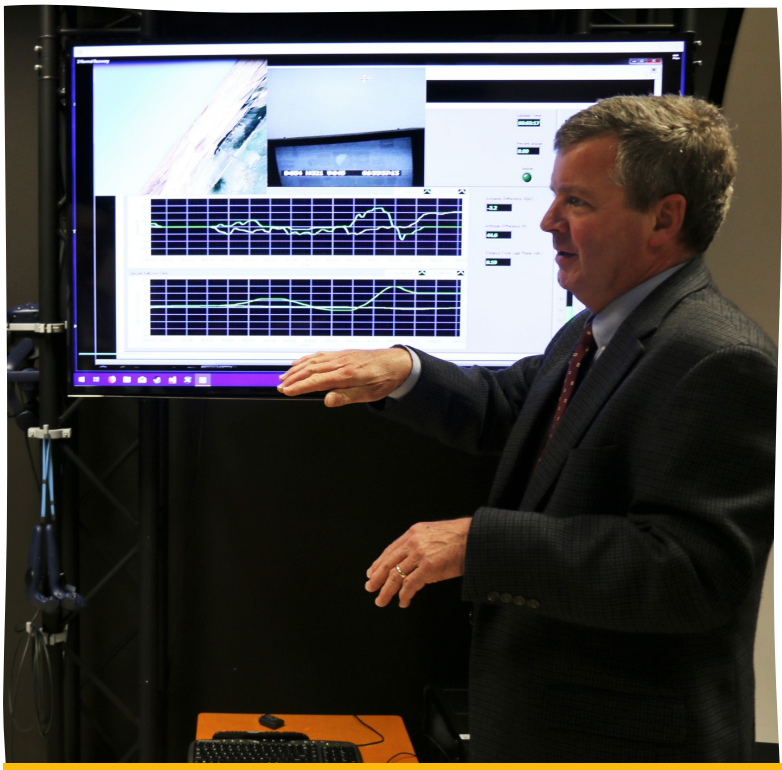
We will test this idea using NAMRU-Dayton's in-house Disorientation Research Device (DRD), affectionately called the Kraken. Volunteer participants will experience different degrees of head and body motion on the roll axis, with movement controlled either by the experimenters or the subjects themselves. We expect that subjects' perceptions of roll will be more accurate when they control the motion.

This study will help us better understand how pilots are likely to interpret vestibular sensations under conditions that more closely match the flight environment, helping to identify when the risk of SD is greatest.

The second study is a Joint Program Committee-5 (JPC-5) funded effort that will develop and test a training intervention to help pilots manage attention during periods of high workload. Our team of subject matter experts includes Drs. Jeffrey Phillips, Henry Williams, Frederick Patterson, Vincent Billock, Nick Fogt, and Lt. Cmdr. Micah Kinney.

Current SD training is mostly lecture-based and offers background on different types of illusions and conditions to be aware of in the flight environment. However, there is little opportunity for hands-on practice and the training does not provide many specific strategies for effectively avoiding SD. This project will develop a novel training program to bridge the gaps in current training.

Our study has two parts. First, we will use simulated SD scenarios to examine how pilots' instrument scanning behaviors change in response to increasing workload, and how the risk of SD changes as a result. Second, we will use that information to develop and evaluate a training program to help pilots better manage their attention during periods of high workload and maintain spatial awareness. We hope that the new training will complement existing training to reduce the risk of SD moving forward.



Naval Medical Research Unit Dayton's (NAMRU-Dayton) senior research psychologist, Dr. Henry Williams explains a research effort looking to better understand spatial disorientation in our spatial disorientation simulator labs. NAMRU-Dayton's Naval Aerospace Medical Research Laboratory has five flight simulation stations with a wide range of fields-of-view. Additionally, NAMRL can simulate day and night with full flight parameter and pilot performance data recording modules. (Photo courtesy of NAMRU-Dayton/Released)

Although spatial disorientation is a stubbornly persistent problem, NAMRU-Dayton's continued research efforts position us to help better understand, predict, and ultimately mitigate this deadly threat.

Probiotics & the Warfighter

By Richard Agans, Ph.D.

Dr. Richard Agans, molecular biologist and microbiologist supporting the Naval Medical Research Unit Dayton's (NAMRU-Dayton) Environmental Health Effects Laboratory (EHEL) is an investigator on a recently published study on behalf of the Tri-Service Microbiome Consortium. The study looked at the potential impacts of probiotic supplementation among service personnel. (Photo courtesy of NAMRU-Dayton/Released)

Humans are a complex system and home to trillions of microscopic organisms. Unique microbial communities are found all across our skin, mouths, lungs, ears, throughout our gastrointestinal tract, and more. These communities contain bacteria, fungi, and viruses all living together in a balance with their human host. In fact, humans have evolved so much that we have developed two-way communication and reliance with our microbial passengers. Bacteria are the predominant members of these communities and are of interest to researchers looking to understand just how important a role they play in our well-being.

In recent years, scientists have learned a great deal about human-inhabiting bacteria, especially those within the gastrointestinal tract, which is home to over 1,000 different bacterial species. They help us metabolize the foods we eat, they fight against disease causing microbes, communicate with our immune system to help it recognize good from bad, and provide us with a number of compounds that our bodies need. In fact, if this community changes (loss of certain species or addition of pathogens) it can lead to negative physical and mental consequences. There are many different ways to perturb this bacterial community, many of which our service members are regularly exposed to.

The Tri-Service Microbiome Consortium (TSMC) aims to understand this complex microbial world and how it impacts military operations and personnel. Recently the TSMC was tasked to address concerns over recent increase in probiotic supplementation among service personnel, assess any potential impacts, good or bad, and report on potential operational applications. The team is comprised of scientific experts from the Naval Medical Research Unit Dayton (NAMRU-Dayton)'s Environmental Health Effects Laboratory, Henry

M. Jackson Foundation for the Advancement of Military Medicine, Soldier Performance Optimization Directorate, U.S. Army Combat Capabilities Development Command, Air Force Research Laboratory, 711th Human Performance Wing, Military Nutrition Division, U.S. Army Research Institute of Environmental Medicine, and Oak Ridge Institute for Science and Education.

Over the course of eight months, the TSMC reviewed 150 reports and studies focusing on probiotic use in healthy populations and impacts to health and performance, specifically exercise performance, muscle-damage, training stress-induced respiratory and gastrointestinal immune modulations, mood, emotion, anxiety, depression, attention, stress, and wound healing. Of the data collected, we published a report in the peer review journal Frontiers in Nutrition. The report acknowledges that there is quite a bit of data suggesting the potential for certain probiotic strains to induce biophysiological changes that may offer physical and/or cognitive health and performance benefits in this population.

Our main findings identified the existence of many knowledge gaps whereby health and performance effects were generally not consistent across studies or widespread among the probiotic strains examined. Beneficial findings were generally limited to single studies with small sample sizes. General benefits were seen where probiotic administration appeared to help protect in cases of respiratory disease.

Ultimately, we concluded that there is not significant evidence to support the use of probiotics to promote performance enhancements in healthy service members. However, the plausibility for health and performance benefits remains, and additional research is warranted. The TSMC recommends future standardized research efforts in military cohorts that will aid in assessing the true potential of probiotics for enhancement of physical and psychological health performance of the warfighter.

References

Agans Richard T., Giles Grace E., Goodson Michael S., Karl J. Philip, Leyh Samantha, Mumy Karen L., Racicot Kenneth, Soares Jason W. Evaluation of Probiotics for Warfighter Health and Performance. Frontiers in Nutrition Vol.7, 2020. https://www.frontiersin.org/article/10.3389/fnut.2020.00070

10 YEAR ANNIVERSARY

A Brief History: NAMRU-Dayton

Originally published 10 06 2020.
https://dvidshub.net/r/itc27d

The Naval Medical Research Unit Dayton (NAMRU-Dayton) celebrates ten years of service as a major Department of Defense medical research command. Since the official activation on October 6, 2010, our scientific expertise and unique capabilities in aerospace medicine and environmental health effects supports the command's mission to maximize warfighter performance and survivability.

NAMRU-Dayton was established as a result of a decision made by the 2005 Base Realignment and Closure (BRAC) Commission to form a Center of Excellence for the Navy and Air Force, aligning their aeromedical research, education, and training at Wright-Patterson Air Force Base (WPAFB) in Dayton, Ohio.

As a result of the BRAC directive, the **Naval Aerospace Medical Research Laboratory** (NAMRL), located at Naval Air Station (NAS) Pensacola since 1939, was ordered to relocate to WPAFB to collocate with the United States Air Force's 711th Human Performance Wing (711 HPW). In an effort to further enhance manpower cost savings, the Navy's Bureau of Medicine and Surgery (BUMED), ordered NAMRL to disestablish and merge with the Naval **Environmental Health Effects Laboratory (EHEL)**, established on WPAFB since 1976, to form NAMRU-Dayton.

On June 1, 2011, a commemorative ribbon cutting ceremony marked the grand opening of the Major General Harry G. Armstrong Complex, comprised of several new Navy and Air Force facilities. In addition to Air Force elements from the 711 HPW and U.S. Air Force School of Aerospace Medicine, the complex includes NAMRU-Dayton's command headquarters and research laboratories.

As a subordinate command to Naval Medical Research Center, NAMRU-Dayton conducts aerospace medical and environmental health effects research to enhance warfighter health, safety, performance and readiness.

NAMRL conducts aerospace-relevant research in the biomedical and behavioral sciences. The lab is equipped with capabilities in acceleration and sensory sciences, biomedical sciences, environmental physiology, and engineering and technical services, all of which are supported by a unique collection of state-of-the-science research devices. NAMRL's research portfolio enables NAMRU-Dayton to transition validated knowledge and effective technologies to the fleet, mitigating and preventing leading factors associated with aeromedical mishaps.

EHEL assesses potential health effects associated with exposure to various environmental stressors our military encounters, such as physical stressors and chemical and material hazards. EHEL scientists evaluate the effects of exposure from multiple standpoints. The ultimate objective is to generate appropriate data used in the development of health protective exposure standards for our military and civilian populations.

Together, our extensive capabilities and scientific expertise housed at NAMRU-Dayton enables us to address identified Fleet needs. We remain on the cutting edge of research to maximize warfighter performance and survivability.